AUG 8 1957

MEMORANDUM FOR RECORD

SUBJECT: Intercept Receiver Sensitivities

1. It is believed of significance to sum up the current "state of the art" in ultimate receiver sensitivities. It is now practical to have all receivers at frequencies under 12 kmc/s with noise figures of less than 10 db.

2. In the frequencies of 50 to 600 mc/s, we have had delivered or developed broad-band (2 to 1 frequency range) R.F. amplifiers that use conventional tubes. These boxes have noise figures of better than 5 db. at 50 mc/s and better than 10 db. at 600 mc/s. They have small signal gains up to 30 db.

3. In the frequencies of 1 to 12 kmc/s, we have boxes under development or in being that will produce noise figures of less than 10 db. using travelling wave tubes. These boxes also cover a frequency range of 2 to 1 and have 20-30 db. of small signal gain.

4. In the region of 500 mc/s to 1 kmc/s, a box can be built by either technique (i.e., conventional tubes or a travelling wave tube) that will have less than 10 db. noise figure. No contract has been let in this range since no justifiable operational need has come forward.

5. A project is underway to extend this capability to frequencies above 12 kmc/s with a goal of 75 kmc/s. Results are expected within nine months.

6. It is concluded that:

a. No receiver, crystal-video nor superheterodyne, old or new, need operate today with a higher noise figure than 10 db. at any frequency under 12 kmc/s.

b. Every receiver (crystal-video or superheterodyne, old or new) in ELINT operations where space (1 cubic foot), weight (30 pounds) and power (100 watts) will allow should have these pre-amplifiers with it (less than 1% of existing installations have plans for this addition.)

c. In each case where space, weight and power requirements of b. above can not be met, if 1/12 cubic foot, 7 pounds and 3 watts are available, preamplifiers of lesser effectiveness but with substantial improvement (20 db.) in performance can be and should be added to all crystal-video intercept receivers and some of our superheterodynes.

d. No substantial further improvement in receiver sensitivity can be obtained since Johnson noise (thermal noise) is inherent in every piece of matter (cooling with liquid air, liquid helium, etc. is of course very profitable).

e. Further improvements in intercept sensitivity must come from antenna design (aperature efficiency). (See ESO Memo to D/C dated 27 May 1957 enclosing paper entitled Antennas for Covert Intercept Work).

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